ANCIENT CRUDE-BRICK CONSTRUCTION AND ITS INFLUENCE ON THE DORIC STYLE.[1]

One of the most interesting essays in classical archæology, recently published in Germany, is that by Wilhelm Dörpfeld, with the title at the head of this notice, contained in the volume of essays issued by the students of Professor Ernst Curtius, in commemoration of his 70th birthday. This essay aims at explaining two facts, which have long perplexed students of Greek architecture; first, that there are no known remains of stone buildings which exhibit the beginnings and earlier development of Doric architecture; and, secondly, that the earliest Doric temples which remain, although they show the Doric style already developed, are distinguished from the temples of the best time of that style by their generally low and heavy forms.

It has long been thought that no remains whatsoever of Doric constructions, older than the temples of Corinth, Syracuse, and Selinus exist. Of this supposed fact two explanations have been proposed. Many archæologists, among them Bötticher and Klenze, have contended that the Doric style was invented for stone buildings, and that it came into being by one creative effort, rather than by a slow and gradual process of evolution. But it is hardly in the course of nature for architectural forms to be invented and applied in this sudden way, and most students, therefore, have held to the view of Vitruvius, that the Doric style was the result of wooden constructive methods applied to stone buildings; an opinion justified by the character of many elements of the Doric order, such as the tryglyphs, trunnels, mutules, guttae, and in general the elements of the frieze and cornice, which undeniably point back to original elements of construction in wood. So far as the paucity of remains goes, this theory

[1] Der antike Ziegelbau und sein Einfluss auf den dorischen Stil. By Wilhelm Dörpfeld. In the volume Historische und philologische Aufsätze Ernst Curtius zu seinem siebenzigsten Geburtstage am zweiten September, 1884, gewidmet. Berlin, Verlag von A. Asher & Co., 1884.

is as complete as the former; wooden buildings would not have come down to our time.

The defenders of the former theory, however, call attention to the fact that the forms of the earliest Doric temples which do survive are, in one respect, not such as those to which wooden construction would naturally give rise. The use of wood is likely to make buildings high and light; as may be seen, for example, in the Ionic style, whose origin is generally admitted to have been in wood. And the tendency in a style which began with wood, and was transferred to stone, would be from the lighter to the heavier; whereas the tendency in the Doric style was, in general, from heavier to lighter. The theory of Vitruvius, then, appears also to be insufficient, and we need some further explanation of the facts.

But, considering the many evidences of the influence of wooden construction on the Doric style, and considering that Vitruvius speaks with a positiveness which appears to proceed not only from theory, but also from some sort of traditional information, we may say that such a new explanation should not deny that there was a stage of Doric architecture in which the use of wood was largely influential in determining forms, but should rather strive to show how this construction in wood came to be so heavy in its proportions. Such an explanation Dörpfeld gives; on the whole a most satisfactory one, well fitted to mark the farthest point to which as yet our knowledge of the origin of Doric architecture has reached.

In both the oldest civilizations of the ancient world, Egypt and Mesopotamia, an extensive use was made of bricks for building purposes. Especially was this true of Mesopotamia. We believe we are right in saying that not a single building has been found in that country, of a time earlier than the Persian Empire, in which stone was used as the chief material. The greatest use made of stone was for the revetment of brick walls, or for the retaining walls of the mounds of clay on which palaces or temples were built, or for the socles of heavy walls, or, in one case, at Khorsabad for the facing of the stereobate of a temple. Stone was also used, as we know from Herodotus and other sources, for such constructions as bridges and quays, where bricks were manifestly less suitable. But in general the Mesopotamians used brick, and brick only, for a building material. Furthermore, their bricks, even when used in places which seem to us to demand unusual hardness, such as arches and vaults,

were generally not baked. They were of crude clay, well worked, mixed with chopped straw, and dried more or less in the sun. They were used either without mortar, or cemented by clay just like their own substance, though somewhat more moistened. The effect of this use of clay was that the forms of Mesopotamian architecture were exceedingly heavy. The walls and partitions of the palace of King Sargon at Khorsabad varied from nine to twenty-four feet in thickness; and everything tends to prove that such buildings were of but one story in height.

Other nations which more or less directly came into contact with the people of Egypt and Mesopotamia, also used crude bricks largely. As to the Phœnicians we lack information, but the paucity of architectural remains in their country may be partially accounted for by the supposition that it was customary there to build much with crude bricks. Along the Asiatic coast of the Ægean crude bricks were much used. The latest explorations at Hissarlik have proved that the Pergamos of Ilion was built of them, both its walls of defence and the walls of the buildings on it. Vitruvius informs us that important crude-brick structures in Asia Minor, at a later time, were the residence of the Attalid kings at Tralles, the palace of Crœsus at Sardis, and that of Mausolus at Halicarnassus. In Greece itself we find ample evidences of the use of unbaked bricks. There are references to it in Herodotus, Thucydides, Aristophanes,[1] Pausanias, Vitruvius, and other writers; inscriptions also refer to it. We are told that a part of the city walls of Athens and of the Long Walls was built of these bricks, that the city wall of Mantineia was of them, that at Patras a temple existed whose walls were constructed of them, etc. Dörpfeld especially calls attention to a stoa at Epidauros, mentioned by Pausanias as of unbaked bricks.[2] The valley of the sacred precinct at Epidauros is so rich in

[1] A joke in the "Clouds" illustrates how common was the use of these bricks in the time of Aristophanes. The chorus of Clouds says:

Ἦν δ' ἀτιμάσῃ τις ἡμᾶς θνητὸς ὢν οὐσας θεὰς
Προσχέτω τὸν νοῦν, πρὸς ἡμῶν οἷα πείσεται κακά,
. . . . . .
. . . . . .
Ἦν δὲ πλινθεύοντ' ἰδωμεν, ὕσομεν καὶ τοῦ τέγους
Τὸν κέραμον αὐτοῦ χαλάζαις στρογγύλαις συντρίψομεν.

[2] The passage from Pausanias is as follows: καὶ, ἦν γὰρ στοὰ καλουμένη Κότυος, καταρρυέντος δέ οἱ τοῦ ὀρόφου διέφθαρτο ἤδη πᾶσα, ἅτε ὠμῆς τῆς πλίνθου ποιηθεῖσα, ἀνῳκοδόμησε [ὁ Ἀντωνῖνος] καὶ ταύτην. II, 27, 7. We give this as illustrating the way in which such a building became ruined.

good building-stone, and so poor in clay, that the builders must either have found great advantages in the latter, or followed a very strong tradition in choosing it.

It has been the custom of explorers, whenever they came to a brick wall, to consider it of late construction and to destroy it. There are, therefore, few actual remains of such walls to be referred to. But at Eleusis a brick wall, 4.50 m. thick, and over 3 m. high, has been found; at Tiryns on the citadel ancient brick walls were found; and the débris, which covered the walls of the recently excavated palace, consisted in large degree of half-burned fragments of brick; at Mycenae a great wall, originally of crude brick cemented with clay, since become, through the action of fire, a solid mass of burned brick, is visible on the summit of the Acropolis; finally, at Olympia, Tegea, and elsewhere, remnants of such walls have been found.

We can hardly doubt that, if construction with crude brick was common among the earlier Greeks, even in public buildings, it must at least have powerfully influenced construction in stone. And there are certain peculiarities in the existing stone walls of Doric temples which can best be explained by this influence and which, in short, afford reasons for believing that these stone walls were built directly after the model of crude-brick walls, were in fact developed from them; and that, in the earlier days of Doric architecture, the walls of the cella, pronaos and opisthodomos were themselves of this material.

As is well known, the temple walls of the Greeks consisted of a socle, or foundation, of blocks much higher than the courses above them. Now, in order to prevent crude-brick walls from absorbing moisture from the ground, and so giving way, they must be raised upon a foundation of some harder material. This must be done also to prevent the lower part of them from being injured by accident, or else they must be revetted with slabs of stone, as was done in Assyria. The socle, then, which exists in stone walls, where it is practically unnecessary, seems to be a reminiscence of the socle of crude-brick walls, where it was indispensable. It is to be remarked, also, that the Greeks called the stones of the courses above the socle in stone walls "bricks" (*πλίνθοι*).

Not only were the cella-walls of Doric temples built with an unnecessary socle, but the treatment of the openings in them, also, shows the influence of a method not strictly appropriate to stone.

In many cases (*e. g.*, the Parthenon and Propylaea at Athens), the door-frames were neither made of separate blocks of stone, nor worked upon the blocks composing the cella-wall. They consisted, as can be proved, of wooden posts, probably covered with bronze—a method of framing singularly like that employed by the Assyrians and Chaldæans. These wooden door-frames are essential with crude-brick walls, to protect the sides of the door-way from injury, and to bear the weight of the doors. They would be covered with bronze plates after a practice, common in Greece, as well as in the East. The charred remains of such door-posts have been dug up at Tiryns and at Troy.

Concerning the method of manufacturing crude bricks in Greece, and of making walls of them, we have information from Vitruvius, and we can gather something from the remains of the walls themselves. The clay was not treated by the Greeks as carefully as by the Mesopotamians, but was allowed to retain pebbles, shells, and potsherds. It was mixed with chopped straw, and then allowed to dry for a long time, even for several years. Vitruvius informs us that there was a decree of the city of Utica that no one should use sun-dried bricks until they had been examined by the magistrates whose duty it was to see that they were sufficiently dried. The greater solidity of their bricks allowed the Greeks to make their walls less thick, though even they found 1.25 m. of thickness as little as was practicable for rooms from four to ten metres wide. The ends of the walls were protected by wooden posts, and the walls themselves were covered with a coating of plaster, composed either of clay, as at Troy, or of lime, as at Tiryns. Thus the wall was protected from the weather so long as the roof remained intact. How soon destruction came to the whole edifice, if the roof was injured, the passage from Aristophanes quoted above indicates.

How, then, may one of these ancient Doric temples, with cella-wall of crude brick, have appeared? We must suppose a stereobate and stylobate of stone for the brick walls to rest upon. The pronaos, formed like a temple *in antis*, has on either side two short brick walls, ending in wooden antæ. Between the antæ are two columns of wood, resting on stone bases, or directly upon the stone stylobate. From anta to anta above the columns runs a wooden architrave. This architrave takes the form, over the brick walls, of a heavy plank, upon which the roofing-timbers rest. These roofing-timbers,

or rafters, reach from wall to wall of the cella, and their covered ends form tryglyphs. The roof seems likely to have been originally horizontal, and composed of the rafters with planks across them bearing a layer of clay, rolled or trodden down hard, after the fashion so common in the East, even at the present day.

After the discovery of the value of burned tiles for roofing, the gable-roof was developed, or imported from Phœnicia. But the buildings of Troy and Tiryns still had horizontal clay roofs. If we imagine such an early building as peripteral, there would be about the cella a series of wooden pillars with stone bases, bearing an epistyle beam, upon which the lengthened timbers of the roof rest; thus the pteroma would be formed.

In a structure like this the thickness of the cella-wall would come to be the modulus for the proportions of the columns, of the epistyle, and in a degree of the whole building. Supposing the breadth of the the cella to be from six to eight metres, the wall would be, judging from the remains at Troy, 1.25 m. Such a wall of crude brick could hardly be built higher than 5 m. with strength to uphold a heavy clay roof. The wooden antæ would then also be 5 m. high and 1.25 m. wide. These are noticeably heavy proportions. At first the pillars between the antæ may have been of less size than the antæ themselves; but with builders so sensitive as the Greeks, this disproportion would soon be felt, and the pillars made thicker. So, too, the epistyle would be made to correspond to its supports; unless, indeed, the mere weight of the roof made a heavy epistyle necessary.

This, in its main features, is Dörpfeld's theory of the earlier stage of the Doric style. It is a theory which seems to match with the facts. But one further test can be applied to it: Do any remains of buildings of such a stage exist? Or, since the upper part of such buildings must long since have perished, do any remains exist of stone substructures whose condition and peculiarities can only be explained in this manner? Dörpfeld thinks he has found such a construction in the Heraion at Olympia.

As yet no complete account of this Heraion has been published; we may, therefore, give a brief summary of Dörpfeld's description of it. In form it is a peripteral temple, with a long pronaos, cella and opisthodomos. On the spot are now to be seen the outer stylobate with fragments of most of the columns; the walls of the cella, pro-

naos and opisthodomos; some fragments of the two columns of the pronaos; and small remains of the inner stylobate.

The fragments of the columns, however, are curiously different from each other. They are not alike in material, form, or technical peculiarities. In short, they cannot all have been put in position at the same time, much less at the time when the temple was erected. There must have been other supports originally; and only as these for some reason gave out, were the present columns put in. Evidently, only wooden pillars would thus have given out; and this supposition is confirmed by Pausanias, who tells us that, in his time, an ancient wooden pillar was still preserved in its place in this temple. We may add that there has not been found a fragment of the entablature of the Heraion; while there are numerous remains of the stone crowning-members of all the other buildings at Olympia. It seems probable, then, that the entablature also in the Heraion was of wood.

When the building was uncovered, the walls were found to consist of a socle of ancient workmanship, made of large squared blocks of stone, with an upper part composed of the bases of statues, poros, and limestone, evidently the construction of Byzantine builders. But why did not those builders leave the entire wall as it stood, as well as the stone socle, if that wall was, like the socle, of stone? Or, even if it was of baked bricks, why do not some portions of it remain? The Byzantine builders would not have taken the trouble entirely to tear down and rebuild the upper part of the wall, if it had been in existence. It cannot have been in existence when they wished to reconstruct the temple; it must have been of some less enduring material than stone or burnt bricks. There are only two such materials, wood and crude bricks. But, as the socle shows, the wall was 1.19 m. thick—thicker than any wooden wall can have been made. We are compelled to believe, then, that the upper part of the walls of the Heraion was of crude bricks.

Happily, other facts confirm this belief. When the Heraion was uncovered, there was found upon the stone foundation, and reaching to some distance on every side, a layer of yellowish clay, about a metre in thickness. At first this clay was thought to have come from a land-slide off Mt. Kronion; but it was seen that such a land-slide would have covered other buildings. The clay could only have come, then, from the disintegrated walls. These walls, in their

original condition, must have had corner-pillars and antæ of wood; traces of wooden door-frames can still be seen.

There is, then, good evidence that there exist, in the Heraion at Olympia, remains of Doric architecture in its earlier and less developed stage: and thus, not only does the opinion of Vitruvius and later scholars seem to be confirmed, that the Doric style was not created all at once and for stone, but also their theory of the origin of that style in wood is corrected and filled out. Modern investigators must hereafter treat brick walls with more respect than they have been treated in the past, as likely to throw important light on the still obscure history of the Doric style.

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